IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Appellants :	Itschak Weissman et al.
Application No.:	10/765,542
Filed:	January 26, 2004
Title:	ENHANCED DENOISING SYSTEM

Examiner:	Rahel Guarino
Art Unit:	2611
Docket No.:	200208667-1
Date :	December 9, 2010

APPEAL BRIEF

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Sir:

This appeal is from the decision of the Examiner, in an Office Action mailed July 9, 2010, finally rejecting claims 19, 24-26 and 30-32 and objecting to claims 20-23, and 27-20.

REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 20555 S.H. 249 Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

RELATED APPEALS AND INTERFERENCES

Appellants' representative has not identified, and does not know of, any other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 19, 24-26 and 30-32 and objected claims 20-23, and 27-20 are pending in the application. Claims 1-18 have been cancelled. Claims 19, 24-26 and 30-32 and objected claims 20-23, and 27-20 were finally rejected in the Office Action dated July 9, 2010. Appellants appeal the final rejection of claims 19, 24-26 and 30-32 and objected claims 20-23, and 27-20 which are copied in the attached CLAIMS APPENDIX.

STATUS OF AMENDMENTS

No Amendment After Final is enclosed with this brief. The last Response was filed March 30, 2010.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent Claim 19

Claim 19 is directed to an apparatus for denoising an input noisy signal, the apparatus comprising one or more memories (112 and 113 in Figure 1); and a controller (111 in Figure 1) that receives the noisy signal z (21 in Figure 1) that includes a number of sequentially ordered symbols, each symbol having a position (page 2, lines 23-25), stores the noisy signal z in the one or more memories (page 6, line 20), receives a signal r (24 in Figure 1), output from a preliminary denoising system (120 in Figure 1) that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position (page 2, lines 25-27), stores the signal r in the one or more memories (page 2, lines 25-27), and produces an output signal z' (22 in Figure 1) by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation (page 4, line 13 to page 9, line 20).

Independent Claim 26

Claim 26 is directed to a method for denoising a noisy signal (21 in Figure 1) and partially corrected signal (24 in Figure 1) to generate an output signal (22 in Figure 1), the method comprising receiving the noisy signal z (21 in Figure 1) that includes a number of sequentially ordered symbols, each symbol having a position (page 2, lines 23-25), storing the noisy signal z in one or more memories (page 6, line 20), receiving the partially corrected signal r (24 in Figure 1), output from a preliminary denoising system that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position (page 2, lines 25-27), storing the partially corrected signal r in the one or more memories (page 2, lines 25-27), and producing the output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation (page 4, line 13 to page 9, line 20).

Independent Claim 32

Claim 32 is directed to a computer readable medium encoded with a data processing program for denoising a noisy signal (21 in Figure 1) and a partially corrected signal (24 in Figure 1) to generate an output signal (22 in Figure 1) by receiving the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position (page 2, lines 23-25), storing the noisy signal z in one or more memories (page 6, line 20), receiving the partially corrected signal r, output from a preliminary denoising system that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position (page 2, lines 25-27), storing the partially corrected signal r in the one or more memories (page 2, lines 25-27), and producing the output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation (page 4, line 13 to page 9, line 20).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. The rejection of claims 19, 24-26, and 30-32 under 35 U.S.C. §102(e) as being anticipated by Lemma et al., U.S. Patent No. 7,266,466 ("Lemma").

ARGUMENT

Claims 19-32 are pending in the current application. In an office action dated July 9, 2010 ("Office Action"), the Examiner rejected claims 19, 24-26, and 30-32 under 35 U.S.C. §102(e) as being anticipated by Lemma et al., U.S. Patent No. 7,266,466 ("Lemma"). In addition, the Examiner conditionally allowed claims 20-23 and 27-29. While Appellants are grateful for the conditional allowance of claims 20-23 and 27-29, Appellants continue to traverse the 35 U.S.C. §102(e) rejections of claims 19, 24-26, and 30-32.

ISSUE 1

1. The rejection of claims 19, 24-26, and 30-32 under 35 U.S.C. §102(e) as being anticipated by Lemma et al., U.S. Patent No. 7,266,466 ("Lemma").

In a response filed March 30, 2010, Appellants addressed the Examiner's rejections as follows:

> As suggested by the title of the current application, "Enhanced Denoising System," the currently claimed "apparatus for denoising an input noisy signal" is directed to denoising received noisy signals to output denoised signals corresponding to the received noisy signals. Noisy signals are signals that have been transmitted through a communications medium, stored and retrieved from a mass-storage device, or similarly affected by electronic systems that convert certain of the original-signal symbols to different, noisy signals as a result of errors in the communications medium or other electronic system. This is explained in the background-of-the-invention section of the current application that begins on line 10 of page 1 of the current application.
>
> By contrast, Lemma is concerned with rescaling the frame sequence of a received signal, as described in Lemma's abstract:
>
>> Method and apparatus are described for compensating for a linear time scale change in a received signal, so as to correctly rescale the frame sequence of the received signal. Firstly, an initial estimate of the sequence of symbols is extracted from the received signal. Successive estimates of correctly time scaled sequences of the symbols are then generated by interpolating the values of the initial estimates.
>
> In particular, as stated beginning on line 10 of column 1 in Lemma, Lemma is concerned with decoding information embedded in information signals, such

as audio or video signals, which comprises a watermark:

> The present invention relates to apparatus and methods for decoding information that has been embedded in information signals, such as audio, video or data signals.
>
> Watermarking of information signals is a technique for the transmission of additional data along with the information signal. For instance, watermarking techniques can be used to embed copyright and copy control information into audio signals.

The link between watermark extraction and rescaling of frame sequences with respect to time is provided in the paragraph that begins on line 29 of column 1:

> In digital devices, it is typically assumed that there exists up to a 1% drift in sampling (clock) frequency. During transmission of the signal through an analog channel, this drift is normally manifested as a stretch or shrink in the time domain signal (i.e. a linear time scale change). A watermark embedded in the time domain (e.g. in an audio signal) will be affected by this time stretch or shrink as well, which can make watermark detection very difficult or even impossible. This, in the implementation of a robust watermarking scheme, it is extremely important to find solutions to such time scale modifications.

Clearly, the current application is directed to entirely different subject matter than that to which Lemma is directed. The current application is directed to a system and method by which noisy symbols are detected in a noisy sequence and replacement symbols are substituted for the detected noisy symbols in order to produce a denoised signal that is as close as possible to the original signal. By contrast, Lemma is concerned with time rescaling, principally of analog signals. Lemma does not teach, mention, or even remotely suggest an apparatus for denoising an input noisy signal or a "method for denoising a noisy signal and partially corrected signal to generate an output signal." Instead, Lemma is concerned with extracting encoded watermark information from an input signal.

In the rejection of claim 19, the Examiner cites Figure 8 as disclosing "an apparatus for denoising an input noisy signal." Figure 8 is entitled: "Watermark symbol Extraction stage." In column 3 of Lemma, Lemma describes Figure 8 as "a diagram illustrating a watermark detector in accordance with an embodiment of the present invention." Clearly, Figure 8 does not teach, mention, or suggest "an apparatus for denoising an input noisy signal."

In the rejection of claim 19, the Examiner cites lines 37-40 of column

> 8 as teaching a received noisy signal. However, that passage of Lemma discusses "the noisy part of the energy function E[m]." By "noisy part," Lemma is referring to the rapidly varying part of the energy function, in contrast to the "slowly varying part" discussed in the following sentence. The energy function E[m] is a computed function that associates a computed numerical value to each signal frame within a portion of a signal, one numerical value per frame. The energy function E[m] is not, and is not in any way related to, a "noisy signal z that includes a number of sequentially ordered symbols." The expression for the energy function E[m] is provided as equation 11 in column 7, and the function is described in the paragraph that begins on line 50 of column 7. Thus, the citation to lines 37-40 of column 8 makes no sense.
>
> The Examiner refers to a notation Y_b as "a number of sequentially ordered symbols" included within a noisy signal, but provides no reference to any passage or figure in Lemma that indicates this to be the case. Moreover, as discussed above, the energy function E[m] is a function, not a signal, and the function associates a numerical value with each frame of a signal. The energy function does not include sequentially ordered symbols. The Examiner cites Figure 12 for the proposition that each symbol in what the Examiner has incorrectly asserted to be a sequentially ordered set of symbols Y_b, has a position, Figure 12 teaches nothing regarding Y_b. Lemma states, in column 11, beginning on line 19, that Figure 12 "illustrates four buffers (B1, B2, B3, and B4), each buffer shown as a row of boxes, with each box within a row indicating a separate location within the respective buffer." Figure 12 would appear to have nothing whatsoever to do with sequentially ordered symbols. The remaining citations made by the Examiner with respect to claim 19 appear to be equally nonsensical. Similar citations are made with respect to claim 26, beginning on the bottom of page 3 of the Office Action.
>
> Lemma is unrelated to the currently claimed invention and current application. Extracting watermarks from a signal has nothing whatsoever to do with denoising noisy signals. The Examiner has failed to point to anything in Lemma regarding noisy signals or denoising of noisy signals. The Examiner's citations to various symbols and figures of Lemma are unrelated to the claim language with respect to which they are cited. In Applicants' representatives' respectfully offered opinion, Lemma provides no basis for any type of claim rejection, particularly a 35 U.S.C. §102 claim rejection, of the current claims.

Apparently, Appellants' representative's points were not fully appreciated by the Examiner. In section 3 of the Office Action, the Examiner states:

> In response to applicant's argument that <u>Lemma</u> is nonanalogous (*unrelated*) art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed rejection. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

> In this case, Lemma discloses a method and apparatus for compensating changes in the received signal. The method and apparatus use plurality of buffers (*N_b 320*), a controller *(24)* and E[m] noisy part (col. 8 lines 37-40), which includes *(Y_b)*, sequence of symbols. Each symbol is sequentially arranged in the buffers *(for ex. Fig. 12 shows location of the symbols in rows; col. 11 lines 30-35).* Different estimates of the symbols within the buffers *(previously estimated W_{11} from buffer one will be taken to buffer four, etc.)* will be replaced with other symbol until the sequential symbol collection is repeated until the end of the buffer is reached; col. 13 lines 46-55).
>
> Furthermore, Lemma teaches applying the method and apparatus other type signals.

First, Appellants' representative did not state or suggest that Lemma is nonanalogous art. Lemma is completely and entirely unrelated to the current application and current claims. Lemma does not teach, disclose, mention, or even remotely suggest that for which it is cited by the Examiner. Those with knowledge of computer science and electrical engineering would immediately understand that the currently claimed apparatus for denoising a signal that comprises a number of sequentially ordered symbols by replacing noisy signals with replacement symbols, a form of discrete denoising, is completely and entirely unrelated to Lemma's method and apparatus for compensating for a linear time scale change in a received signal so as to correctly rescale the frame sequence of the received signal. Compensating for a linear time scale change has nothing whatsoever to do with denoising a signal comprising a number of sequentially ordered symbols by replacing certain of the symbols in the signal with replacement symbols.

Second, the Examiner's narrative with respect to Lemma, as quoted above, is both incorrect and irrelevant to the current claims and current application. For example, the Examiner cites the item labeled "24" in Figure 1 of Lemma as a controller, apparently somehow regarding this "controller" as equivalent to the controller of claim 19 of the current application that:

> receives the noisy signal *z* that includes a number of sequentially ordered symbols, each symbol having a position,
>
> stores the noisy signal *z* in the one or more memories,
>
> receives a signal *r*, output from a preliminary denoising system that operates on the received noisy signal *z*, that includes a number of sequentially ordered symbols, each symbol having a position,
>
> stores the signal *r* in the one or more memories, and
>
> produces an output signal *z'* by replacing a symbol within each of a number of different subsequences that occur in the noisy signal *z* with a corresponding replacement symbol that the controller computes to provide a

minimal estimated signal degradation.

However, Figure 1 of Lemma "shows a block diagram of the apparatus required to perform the digital signal processing for embedding a multi-bit payload watermark w into a host signal x," as stated in the paragraph that begins on line 46 of column 3. Item "24" in Figure 1 is a "gain controller 24 [that] is used to amplify or attenuate the signal by a gain factor α." No one having familiarity with electronics or computing would fail to understand that the controller claimed in claim 19 of the current application is a processor that carries out the above-quoted processing steps while the gain controller mentioned by Lemma is simply a hardware amplifier. Lemma's gain controller is not a general purpose processor, does not receive a noisy signal, does not store a noisy signal in memory, does not receive a second signal output from a preliminary denoising system, store that second signal in memory, and does not produce an output signal by replacing received-signal symbols with replacement symbols. Those with a background in electronics would immediately recognize that the gain controller illustrated in Figure of Lemma is a simple amplifier that receives a product of a watermark signal w_c and an audio signal x, both analog signals, and amplifies this single received signal prior to passing the amplified signal to an adder (22 in Figure 1). The apparatus shown in Figure 1 of Lemma processes analog, audio signals, while the current claims are directed to denoising of discrete signals comprising sequentially ordered symbols. The currently claimed controller, or processing element, that carries out the steps quoted from claim 19, above, is completely unrelated to an analog-signal amplifier, which is a very simple hardware-circuit component.

The Examiner again cites lines 37-40 of column 8 of Lemma as teaching a noisy part, whatever the Examiner means by the phrase "noisy part," while, in the cited passage, Lemma is discussing the "noisy part of the energy function E[m]." The "noisy part" of an energy function has nothing whatsoever to do with a noisy signal comprising a number of sequentially ordered symbols, as would be apparent to those with a background in computing or electronics. The passage on lines 37-40 of column 8 does not mention anything regarding Y_b and does not teach, disclose, mention, or suggest anything at all regarding a sequence of symbols. The cited passage includes an expression involving a low pass filter function. Low pass filters can be applied to continuous, analog signals, but have no application to sequences of symbols stored in electronic memories. Figure 1 of Lemma shows an apparatus for embedding a watermark in an analog signal. Figure 12 of Lemma

illustrates estimation of watermark symbols within the watermark detector shown in Figure 8 of Lemma. The watermark detector is a completely separate apparatus from the watermark embedding apparatus shown in Figure 1. For some reason, the Examiner cites both Figure 1 and Figure 12, which relate to completely different devices, as if both figures were related to a single device.

The Examiner has completely mischaracterized the passage on lines 46-55 of column 13, claiming that estimates of symbols within buffers are replaced with other symbols. This entire portion is reproduced below:

> When the audio signal is time scale modified, the start and the end of the framing will gradually drift backward or forward, depending respectively upon whether the signal is time scale stretched or compressed. The watermark symbol combining stage according to this embodiments tracks the size of the drift. When the absolute value of the cumulative drift exceeds T_s/N_b (where N_b is the number of buffers i.e. the number of consecutive symbols that represent a single watermark symbol), then the symbol collection sequence from the buffers is adjusted to provide the next best estimate of the symbol from the buffers. In other words, the buffer counters are incremented or decremented (depending on drift direction), and a circular rotation of the buffer pointer for each watermark sequence estimation (W_{f1}, W_{f2}, W_{f3}, W_{f4}) is performed.
>
> Let k be the buffer entry counter, where k is an integer representing each location within each buffer i.e. k=1 represents the first location within each buffer, k=2 the second etc. If the estimates of the watermark sequence are being taken from the buffers with no time scale modification (as shown in FIG. 12), then it will be appreciated that the values in the first sequence can be represented by $W_{f1}[k]$.
>
> However, for time scaled estimates, assuming than an estimate η is being made of the time scale, then when
>
> $$|\eta k| \approx \frac{n}{Nb},$$
>
> where n is any integer (and in this example N_b=4), the counter values and the buffers from which the watermark estimates are taken are changed.
>
> If η is positive (time stretch), the counter for the first buffer is incremented. The ordering of the buffers is also circularly shifted (i.e. the watermark sequence estimate W_{f1} previously being taken from buffer one will now been taken from buffer four, the estimate from buffer two will now be taken from buffer one, the estimate from three will now be taken from buffer two, and the estimate from buffer four will now be taken from buffer three.). A similar circular shift is also performed on the buffer counter k. This is shown

diagrammatically in FIG. 13*a*.

If η is negative (time stretch), the counter for the first buffer is incremented, and the ordering of the buffers is circularly shifted (i.e. the watermark sequence estimate W_{η} previously being taken from buffer one will now be taken from buffer two, the estimate from buffer two will now be taken from buffer three, the estimate from three will now be taken from buffer four, and the estimate from buffer four will now be taken from buffer one). A similar circular shift is also performed on the buffer counter. This is shown diagrammatically in FIG. 13*b*.

After these circular shifts and adjustment to the buffer counters have been performed the symbol collection to form the different estimates of the watermark sequences continues from left to right until $|\eta k| \approx n + 1/Nb$ (i.e. the next interchange position is reached). The process of buffer order interchanging and the sequential symbol collection is then repeated until the end of the buffer is reached.

Consequently, it will be appreciated that a zeroth order interpolation of the time scaled watermark sequence has been performed. In other words, the time scaled watermark sequence has been estimated by selecting those values from the original, non time scaled watermark sequence estimates that would most closely correspond to the temporal positions of the time scaled watermark sequence. By utilizing previously extracted estimates of the watermark sequence, such a technique efficiently resolves the problems of estimating correctly time scaled watermarks, with minimal cost in terms of computational overhead.

Such estimates of the time scale watermark sequence will then be passed to the correlator (410), so as to determine whether the predicted time shift η accurately represents the time shift of the received signal i.e. do the estimates provided to the correlator provide good correlation peaks. If not, then the time scale search will be repeated for a different estimated value i.e. a different value of η.

Those familiar with electronics and computer science would immediately recognize that Lemma is discussing, in the above-quoted passage, adjusting framing in order to correct for drift within a signal containing a watermark, and discusses circular-buffer shifting operations used to determine a proper time scale and framing for a watermark embedded in an analog signal. The subject of this passage is the determination of a time shift η. This passage has nothing at all to do with denoising signals comprising a number of sequentially ordered symbols by replacing noisy symbols with replacement symbols.

In the Office Action, the Examiner states, on page 2:

In response to applicant's arguments, the recitation "lemma does not

> teach, mention, or even remotely suggest an *apparatus for denoising an input noisy signal or a 'method of denoising a noisy signal and partially corrected signal to generate an output signal'* has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

The Examiner made an incorrect conclusion based on very old case law. A more modern understanding of the role of a claim preamble can be obtained from the following case law citations:

> If the body of the claim "sets out the complete invention," the preamble is not ordinarily treated as limiting the scope of the claim. Schumer v. Lab. Computer Sys., Inc., 308 F.3d 1304, 1310 (Fed. Cir. 2002). However, the preamble is regarded as limiting if it recites essential structure that is important to the invention or necessary to give meaning to the claim. NTP, Inc. v. Research In Motion, Ltd., 418 F.3d 1282, 1305-06 (Fed. Cir. 2005), cert. denied, 74 U.S.L.W. 3421 (U.S. Jan. 23, 2006); SanDisk Corp. v. Memorex Prods., Inc., 415 F.3d 1278, 1284 n.2 (Fed. Cir. 2005), cert. denied, 126 S. Ct. 829 (2005). That is, if the claim drafter "chooses to use both the preamble and the body to define the subject matter of the claimed invention, the invention so defined, and not some other, is the one the patent protects." Bell Commc'ns Research, Inc. v. Vitalink Commc'ns Corp., 55 F.3d 615, 620 (Fed. Cir. 1995) (emphasis in original). Moreover, when the limitations in the body of the claim "rely upon and derive antecedent basis from the preamble, then the preamble may act as a necessary component of the claimed invention." Eaton Corp. v. Rockwell Int'l Corp., 323 F.3d 1332, 1339 (Fed. Cir. 2003).

Clearly, in claim 19, the body of the claim refers to the language of the claim preamble, including references to "the noisy signal." Similarly, in independent claim 26, the body of claim 26 refers to "the noisy signal" and "the partially corrected signal" first introduced in the preamble as well as to "the output signal," also introduced in the preamble. According to modern case law, therefore, it is clear that the claim drafter, Appellants' representative, fully intended the preamble "define the subject matter of the claimed invention." By not giving patentable weight to the preambles of claims 19 and 26, and justifying this decision based on 34-year-old case law, the Examiner has clearly committed a serious error in claim interpretation. As a result, in Appellants' representative's respectfully offered opinion, the claim rejections must necessarily be overturned.

On page 2 of the Office Action, the Examiner states:

> In addition, applicants are remained that the examiner is entitled to give the broadest reasonable interpretation to the language of the claim and is not limited to Applicant's definition, In re Tanaka et al., 193 USPQ 139, (CCPA) 1977.

Essentially, based on 33-year-old case law, the Examiner apparently feels that the Examiner is entitled to arbitrarily interpret claim language without regard for either the specification or Appellants' statements regarding the definition of claim terms and phrases. This is, of course, a very incorrect conclusion and represents an error in claim interpretation, as a result of which the current rejections should be overturned. The correct standard has been summarized as follows:

> The USPTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the Applicants' specification.

Arbitrary claim interpretation is not allowed by this standard, and an interpretation based on arbitrary interpretation is necessarily fatally flawed.

In rejecting claim 19, the Examiner states that "Lemma discloses an apparatus for denoising an input noisy signal." Lemma does not disclose an apparatus for denoising an input noisy signal. The apparatus shown in Figure 8 of Lemma is, as explicitly stated by Lemma in column 3, a "diagram illustrating a watermark detector in accordance with an embodiment of the present invention." Lemma's watermark detector compensates "for a linear time scale change in a received signal, so as to correctly rescale the frame sequence of the received signal." The Examiner has failed to point to even a single occurrence of the phrase "noisy signal" or the term "denoise" anywhere in Lemma. As discussed above, Lemma is unrelated to denoising of signals and is therefore unrelated both to the current application and current claims. As discussed above, the Examiner attempts, in the rejection of claim 19, to read the following claim language onto a simple gain-amplifier circuit component (24 in Figure 1) that receives an analog signal and outputs an amplified version of the received signal to an adder:

> a controller that
>
> receives the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,
>
> stores the noisy signal z in the one or more memories,

receives a signal r, output from a preliminary denoising system that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position,

stores the signal r in the one or more memories, and

produces an output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.

The only similarity between the gain controller within the apparatus shown in Figure 1 of Lemma and the currently claimed controller is that both are called "controller." No one having familiarity with electronics and computing would assert any type of equivalence between a hardware amplifier and a processing element that receives multiple types of symbol-sequence signals memories, stores symbol-sequence signals in memories, and processes symbol-sequence signals by symbol replacement. Amplifiers do not carry out such processing steps. Moreover, Lemma shows two entirely different devices, a watermark-embedding apparatus, shown in Figure 1 of Lemma, and a watermark-detection apparatus, shown in Figure 8 and subsequent figures. The Examiner has apparently failed to appreciate this fact, and arbitrarily cites components of these two different devices as being components of a single "apparatus for denoising an input noisy signal." Neither of the two devices have anything at all to do with denoising signals.

Despite several explanations to the Examiner of the meaning of Lemma's disclosure, the Examiner again insists that the notation "E[m]" used in column 8 of Lemma refers to a noisy signal. It does not. This notation refers to an energy function. The energy function employed in expression 14 of Lemma is related to application of a low pass filter to an audio signal. The Examiner claims that the notation "Y_b" refers, in Lemma, to a number of sequentially ordered signals. However, while Appellants' representative cannot find exactly that notation proximal to the cited passage of column 8, a similar notation is used in columns 7 and 8, "$y'_b[n]$," that represents the output of a signal conditioning filter that receives an incoming watermark signal, as discussed in the paragraph that begins on line 28 of column 7. It is not a noisy signal, according to Lemma, and appears to be a standard continuous audio signal to which a typical band pass filter has been applied. There is no indication anywhere in columns 7 and 8 that $y'_b[n]$ has anything at all to do with sequentially ordered symbols. The notation "[n]" refers to the n^{th} sample of continuous audio signal, as discussed in the paragraph that begins on line 50 of column 7. No one with a background in

electronics and computing would mistake a sampled audio signal for a number of sequentially ordered symbols. The Examiner refers to item 230 in Figure 8 as a preliminary denoising system, however this item is referred to by Lemma as an "energy calculation unit" on line 21 of column 8. Calculation of an energy function does not constitute preliminary denoising. There is nothing in Lemma that would even remotely suggest classifying the energy calculation unit as a preliminary denoising system. Again, a large portion of columns 13 and 14 were quoted, above, to indicate that the cited portion of column 13 is unrelated to replacing noisy symbols with replacement symbols in order to denoise a signal comprising a sequence of symbols. Instead, as Lemma stresses in the abstract and throughout Lemma's disclosure, Lemma is seeking to compensate for a linear time scale change in a received signal in order to rescale the frame sequence of the received signal. Lemma is unrelated to symbol replacement in order to denoise a signal. Lemma does not once state or in any way suggest that anything disclosed by Lemma is intended to, or inadvertently, carries out any type of denoising. The rejection of independent claim 26 is almost identical to the rejection of claim 19, and also represents a misinterpretation of the unrelated reference Lemma. The rejection of claim 32 parallels the rejections claims 26 and 19, and is as unsupported by Lemma's disclosure as the rejections of claims 26 and 19. Because none of the rejected independent claims are anticipated by Lemma, and because Lemma is not even remotely related to the subject matter of any current claim, it is axiomatic that Lemma cannot possibly anticipate any of the current claims.

CONCLUSION

The current application is directed to denoising noisy signals that comprise sequences of symbols. The denoising methods of the current application are examples of discrete denoising methods that involve replacing certain symbols with replacement symbols. By contrast, as would be immediately recognized by anyone with familiarity with electronics and computing, Lemma discloses an apparatus for detecting a watermark embedded in a continuous audio signal. Lemma's apparatus compensates "for a linear time scale change in a received signal, so as to correctly rescale the frame sequence of the received signal" in order to detect an embedded watermark. Lemma does not once state or suggest that Lemma's apparatus is in any way intended to, or inadvertently carries out, denoising of the continuous audio signal. Those having familiarity with electronics and computing would immediately

recognize that discrete denoising of signals comprising sequences of symbols by a processing component that carries out steps enumerated in independent claims 19, 26, and 32, has no relationship of any kind to a watermark-detection apparatus that detects drift and time scale variation in a continuous audio signal in order to detect an embedded watermark. Moreover, the Examiner has clearly admitted that the Examiner has not applied proper claim interpretation to the current claims, believing that the Examiner can simply ignore claim preambles and arbitrarily interpret claims without considering the meanings of terms and phrases provided by the specification or known to those of ordinary skill in the art.

Appellants respectfully submit that all statutory requirements are met and that the present application is allowable over all the references of record. Therefore, Appellants respectfully request that the present application be passed to issue.

Respectfully submitted,
Itschak Weissman et al.
OLYMPIC PATENT WORKS PLLC

By ______________________
Robert W. Bergstrom
Registration No. 39,906

CLAIMS APPENDIX

1 – 18 Cancelled

19. An apparatus for denoising an input noisy signal, the apparatus comprising:

one or more memories; and

a controller that

receives the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,

stores the noisy signal z in the one or more memories,

receives a signal r, output from a preliminary denoising system that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position,

stores the signal r in the one or more memories, and

produces an output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.

20. The apparatus of claim 19 wherein the controller produces the output signal z' by:

for each of a number of different symbol subsequences, $z(q)$, about symbol z_q, that occur in the received noisy signal z,

counting a number of occurrences of each symbol at the corresponding positions p in signal r, r_p, for positions p in the received noisy signal z at which $z(p)$ is equal to $z(q)$ and storing the counted number of occurrences in the one or more memories; and

for each of the number of symbol subsequences, $z(q)$, in the received noisy signal z,

replacing symbol z_q of subsequence $z(q)$ in all occurrences of subsequence $z(q)$, at positions z_p, in the noisy signal z with a replacement symbol z_q' which produces a minimal computed signal degradation.

21. The apparatus of claim 20 wherein the one or more memories store:

a degradation function C() that ;

the received noisy signal z;

the signal r; and

the counts of the number of occurrences of each symbol at the corresponding positions p in signal r, r_p, for positions p in the received noisy signal z at which $z(p)$ is equal to $z(q)$.

22. The apparatus of claim 21 wherein the replacement symbol $z_q^{'}$ for symbol z_q of subsequence $z(q)$ is computed as a symbol that is computed to produce a least estimated signal degradation, using the degradation function C(), when $z_q^{'}$ is substituted for z_q in each occurrence of subsequence $z(q)$ in noisy signal z.

23. The apparatus of claim 22 wherein the estimated signal degradation produced by replacing symbol z_q of each occurrence of subsequence $z(q)$ with symbol $z_q^{'}$ is computed as:

$$\text{degradation} = \sum_p C\left(r_p, z_q^{'}\right)$$

where $C\left(r_p, z_q^{'}\right)$ is the degradation estimated for replacing the symbol r_p at position p in the signal r with symbol $z_q^{'}$; and

p represents the positions in the signals r and z at which $z(p)$ is equal to $z(q)$.

24. The apparatus of claim 19 wherein a subsequence $z(q)$ is a number of symbols that precede, follow, or both precede and follow a symbol z_q at position q in noisy sequence z.

25. The apparatus of claim 24 in which the number of symbols in a subsequence is determined by the controller to be sufficiently small to ensure that the number of occurrences of each subsequence is sufficiently large to provide a desired statistical significance to signal degradation estimation and sufficiently large to ensure that an adequate number of subsequence correlations contribute to denoising.

26. A method for denoising a noisy signal and partially corrected signal to generate an output signal, the method comprising:

receiving the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,

storing the noisy signal z in one or more memories,

receiving the partially corrected signal r, output from a preliminary denoising system that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position,

storing the partially corrected signal r in the one or more memories, and

producing the output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.

27. The method of claim 26 wherein the output signal z' is produced by:

for each of a number of different symbol subsequences, $z(q)$, about symbol z_q, that occur in the received noisy signal z,

counting a number of occurrences of each symbol at the corresponding positions p in signal r, r_p, for positions p in the received noisy signal z at which $z(p)$ is equal to $z(q)$ and storing the counted number of occurrences in the one or more memories; and

for each of the number of symbol subsequences, $z(q)$, in the received noisy signal z,

replacing symbol z_q of subsequence $z(q)$ in all occurrences of subsequence $z(q)$, z_p, in the noisy signal z with a replacement symbol $z_q^{'}$ which produces a minimal computed signal degradation.

28. The method of claim 27 further comprising computing the replacement symbol $z_q^{'}$ for symbol z_q of subsequence $z(q)$ as a symbol that producesa least estimated signal degradation, using the degradation function C(), when $z_q^{'}$ is substituted for z_q in each occurrence of subsequence $z(q)$ in noisy signal z.

29. The method of claim 28 further comprising computing the estimated signal degradation produced by replacing symbol z_q of each occurrence of subsequence $z(q)$ with symbol $z_q^{'}$ as:

$$\text{degradation} = \sum_p C\left(r_p, z_q^{'}\right)$$

where $C\left(r_p, z_q^{'}\right)$ is the degradation estimated for replacing the symbol r_p at position p in the

signal r with symbol $z_q^{'}$; and

p represents the positions in the signals r and z at which $z(p)$ is equal to $z(q)$.

30. The method of claim 26 wherein a subsequence $z(q)$ is a number of symbols that precede, follow, or both precede and follow a symbol z_q at position q in noisy sequence z, the subsequence including symbol z_q.

31. The method of claim 26 further comprising determining the number of symbols in a subsequence by selecting the number of symbols in a subsequence to be sufficiently small to ensure that the number of occurrences of each subsequence is sufficiently large to provide a desired statistical significance to signal degradation estimation and to be sufficiently large to ensure that an adequate number of subsequence correlations contribute to signal denoising.

32. A computer readable medium encoded with a data processing program for denoising a noisy signal and a partially corrected signal to generate an output signal by:

receiving the noisy signal z that includes a number of sequentially ordered symbols, each symbol having a position,

storing the noisy signal z in one or more memories,

receiving the partially corrected signal r, output from a preliminary denoising system that operates on the received noisy signal z, that includes a number of sequentially ordered symbols, each symbol having a position,

storing the partially corrected signal r in the one or more memories, and

producing the output signal z' by replacing a symbol within each of a number of different subsequences that occur in the noisy signal z with a corresponding replacement symbol that the controller computes to provide a minimal estimated signal degradation.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.